

# **9th International Conference on Auditorium Acoustics 2015**

Proceedings of the Institute of Acoustics Volume 37 Part 3

Paris, France  
29 – 31 October 2015

ISBN: 978-1-5108-1539-1

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2015) by Institute of Acoustics  
All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact Institute of Acoustics  
at the address below.

Institute of Acoustics  
3rd Floor St Peter's House  
45-49 Victoria Street  
St. Albans, Hertfordshire  
AL13WZ  
United Kingdom

Phone: +44(0) 1727 848195

Fax: +44(0) 1727 850553

[ioa@ioa.org.uk](mailto:ioa@ioa.org.uk)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>THE DIFFUSE SOUND FIELD AND ITS RELEVANCE FOR CONCERT AUDITORIA</b> .....	1
<i>M. Barron</i>	
<b>OBJECTIVE AND PERCEPTUAL EVALUATION OF ACOUSTIC SCATTERING FROM A VARIABLE-ACOUSTIC WALL IN A SMALL HALL</b> .....	9
<i>L. Shtrepi, A. Astolfi, M. Rychtarikova, M. Guski, G. D'Antonio</i>	
<b>LISTENING EXPERIENCE SURVEY IN CONCERT HALLS, CASE STUDY OF PHILHARMONIE 2 IN PARIS</b> .....	17
<i>J. Espitia, J. Polack, D. Dubois</i>	
<b>ACOUSTICAL DESIGN OF AN AUDITORIUM WITH A SEMICIRCULAR PLAN SHAPE</b> .....	27
<i>T. Hidaka, T. Nakagawa, S. Koyanagi</i>	
<b>PRESENTATIONAL RHETORIC IN CONCERT HALLS: BEING THERE. "THE OBJECTIVE OF ACOUSTICAL DESIGN."</b> .....	35
<i>H. Marshall</i>	
<b>PRACTICAL APPLICATION AND ANALYSIS OF FULL ORCHESTRA SPATIAL IMPULSE RESPONSES IN AN OPERA HOUSE</b> .....	43
<i>H. Moller, J. Patynen, S. Tervo, T. Lokki</i>	
<b>ARCTIC TRANSFORMATION: A FULLY FLEXIBLE CONCERT HALL/THEATRE IN BODØ, NORWAY</b> .....	51
<i>N. Crowe, I. Knowles</i>	
<b>THE ACOUSTIC DESIGN OF A VINEYARD HALL AND A SHOEBOX THEATRE AT THE NEW KRAKOW CONGRESS CENTRE</b> .....	61
<i>R. Orłowski</i>	
<b>ACOUSTICS OF THE WEIWUYING PERFORMING ARTS CENTER, TAIWAN</b> .....	69
<i>A. Xu, M. Philippe</i>	
<b>THE TAKHT REQUIREMENTS BETWEEN TRADITION AND POPULAR DIFFUSION: SHIFTING VENUES</b> .....	79
<i>Y. Bouhali, J. Polack</i>	
<b>REFLECTIONS ON THE SPATIAL SOUND IMAGINATION OF COMPOSERS</b> .....	87
<i>J. Meyer</i>	
<b>GENESIS OF THE "SALLE DES CONCERTS" AT PARIS LA VILLETTE, A TRIBUTE TO PIERRE BOULEZ</b> .....	97
<i>D. Commins</i>	
<b>PHILHARMONIE DE PARIS – THE ACOUSTIC BRIEF</b> .....	105
<i>E. Kahle, T. Wulfrank, Y. Jurkiewicz, N. Faillet</i>	
<b>THE CONCEPTUAL ACOUSTICAL DESIGN FOR LA PHILHARMONIE DE PARIS, GRANDE SALLE</b> .....	111
<i>H. Marshall, C. Day</i>	
<b>IMPLEMENTING THE ACOUSTICAL CONCEPT FOR THE PHILHARMONIE DE PARIS, GRANDE SALLE</b> .....	118
<i>T. Scelo, J. Valentine, H. Marshall, C. Day</i>	
<b>COMMISSIONING OF THE PHILHARMONIE DE PARIS, GRANDE SALLE</b> .....	128
<i>T. Scelo, P. Exton, C. Day</i>	
<b>THE EFFECTS OF EARLY REFLECTIONS ON PROXIMITY, LOCALIZATION AND LOUDNESS</b> .....	136
<i>D. Griesinger</i>	
<b>AUDITORY DISTANCE PERCEPTION IN CONCERT HALLS AND THE ORIGINS OF ACOUSTIC INTIMACY</b> .....	151
<i>A. Kuusinen, T. Lokki</i>	
<b>MULTIMODAL PERCEPTION IN CONCERT HALLS; WHERE DO WE LOOK WHEN WE LISTEN?</b> .....	159
<i>A. Minors</i>	
<b>SUBJECTIVE IMPACT OF CONCERT HALL ACOUSTICS</b> .....	167
<i>J. Patynen, S. Tervo, T. Lokki</i>	
<b>ENERGY CRITERIA IN ITALIAN HISTORICAL OPERA HOUSES: A SURVEY OVER 11 THEATRES</b> .....	175
<i>F. Morandi, S. Cesaris, D. D'Orazio, M. Garai</i>	

<b>ACOUSTICS OF VANISHED 19<sup>TH</sup> CENTURY CONCERT HALLS IN HELSINKI</b> .....	182
<i>H. Niemi, M. Kylliäinen, J. Jappinen, M. Lindqvist</i>	
<b>CALIBRATED AURALIZATION SIMULATION OF THE ABBEY OF SAINT-GERMAIN-DES-PRÉS FOR HISTORICAL STUDY</b> .....	190
<i>B. Postma, A. Tallon, B. Katz</i>	
<b>ACOUSTIC ANALYSIS OF THE GOTHENBURG KONSETHUS</b> .....	198
<i>A. Wagner, A. Berntson, K. Muller</i>	
<b>THE SECRET OF THE MUSIKVEREIN AND OTHER SHOEBOX CONCERT HALLS</b> .....	206
<i>T. Lokki, J. Patynen, S. Tervo, A. Kuusinen, H. Tahvanainen, A. Haapaniemi</i>	
<b>THE DESIGN OF A MEDIUM-SIZED CONCERT HALL FOR LARGE SYMPHONIC ORCHESTRA: CASE STUDY LE ROSEY CONCERT HALL</b> .....	214
<i>A. Bassuet, A. Guthrie</i>	
<b>FROM THE SOUND UP: REVERSE-ENGINEERING ROOM SHAPES FROM ACOUSTIC SIGNATURES</b> .....	223
<i>W. Boning, A. Bassuet</i>	
<b>DESIGNING DIFFUSERS IN THE TIME DOMAIN</b> .....	240
<i>T. Cox</i>	
<b>APPLYING IN-SITU RECALIBRATION FOR SOUND STRENGTH MEASUREMENTS IN AUDITORIA</b> .....	247
<i>C. Christensen, G. Koutsouris, J. Gil, J. Rindel</i>	
<b>INVESTIGATION OF LISTENER ENVELOPMENT AND THE LATE SOUND FIELD USING SPHERICAL MICROPHONE ARRAY IMPULSE RESPONSE MEASUREMENTS</b> .....	259
<i>D. Dick, M. Vigeant</i>	
<b>MEASURING IMPULSE RESPONSES IN A FULLY OCCUPIED CONCERT HALL USING A TAILOR-MADE ELECTRONIC MUSICAL COMPOSITION - PROOF OF CONCEPT</b> .....	268
<i>C. Hak, R. Wenmaekers</i>	
<b>CAN SOURCE BROADENING AND LISTENER ENVELOPMENT BE MEASURED DIRECTLY FROM A MUSIC PERFORMANCE IN A CONCERT HALL?</b> .....	277
<i>M. Skalevik</i>	
<b>ON-STAGE HEARING: EXPERIENCE FROM ORCHESTRA HALL, MINNEAPOLIS</b> .....	284
<i>E. Green, R. Essert</i>	
<b>HOW A FULL SCALE ORCHESTRA OF DUMMIES ATTENUATES DIRECT AND REFLECTED SOUND</b> .....	292
<i>R. Wenmaekers, C. Hak</i>	
<b>STAVANGER CONCERT HALL, ACOUSTIC DESIGN AND MEASUREMENT RESULTS</b> .....	300
<i>Y. Jurkiewicz, E. Kahle, B. Katz</i>	
<b>POSSIBLE ACOUSTIC DESIGN GOALS IN VERY LARGE VENUES HOSTING LIVE MUSIC CONCERTS</b> .....	308
<i>N. Adelman-Larsen</i>	
<b>A NEW, M. KARLOWICZ PHILHAMONIC ORHestra IN SZCZECIN POLAND</b> .....	317
<i>H. Arau-Puchades</i>	
<b>PERCEPTUAL COMPARISON OF TWO DIFFERENT SIMULATION ALGORITHMS APPLIED ON THE EXAMPLE OF AN OPEN-AIR THEATRE</b> .....	324
<i>E. Bo, D. Pelegrin-Garcia, L. Shtrepi, A. Astolfi, M. Rychtarikova</i>	
<b>A ROOM WITHOUT WALLS: OPTIMIZING AN OUTDOOR MUSIC SHELL TO MAINTAIN VIEWS AND MAXIMIZE REFLECTIONS</b> .....	332
<i>W. Boning, A. Bassuet</i>	
<b>CURRENT CRITERIA FOR ACOUSTIC DESIGN OF SCHOOLS AUDITORIA IN HONG KONG</b> .....	342
<i>D. Booth, D. Chou</i>	
<b>ACOUSTIC DESIGN FOR LA ROMIEU CHURCH CHAMBER MUSIC</b> .....	346
<i>V. Chavez</i>	
<b>RES, RESONANT STRING SHELL, DEVELOPMENT AND DESIGN OF AN ACOUSTIC SHELL FOR OUTDOOR CHAMBER MUSIC CONCERTS</b> .....	354
<i>S. Rosario, B. Parenti, E. Pignatelli, G. Mirra, S. Pone</i>	
<b>REBUILDING OF AN ORCHESTRA REHEARSAL ROOM: COMPARISON BETWEEN OBJECTIVE AND PERCEPTIVE MEASUREMENTS FOR ROOM ACOUSTIC PREDICTIONS</b> .....	374
<i>H. Dujourdy, T. Toulemonde</i>	
<b>RELATIONSHIPS BETWEEN WALL TILT AND SOUND FIELD GROWTH AND DECAY</b> .....	380
<i>R. Essert, E. Green</i>	
<b>IMPROVING THE LABORATORY REPRODUCTION OF CLARITY, PROXIMITY, AND LOCALIZATION</b> .....	388
<i>D. Griesinger</i>	

<b>WHY DO FLUTTER ECHOES “ALWAYS” END UP AROUND 1-2 KHZ?</b> .....	395
<i>T. Halmrast</i>	
<b>SPATIAL DECOMPOSITION AND BEAMFORMING FOR PREDICTING 3D ROOM ACOUSTICS IN CONCERT HALLS</b> .....	409
<i>H. Lim, M. Imran, J. Jeon</i>	
<b>SUBJECTIVE EVALUATION OF STAGE ACOUSTICS IN LIVE JAZZ CONCERTS; MULTI-DIMENSIONAL DESCRIPTION OF EVALUATIONS</b> .....	414
<i>J. Karagiannis, G. Xanthoulis, A. Trispiotis, J. Tzouvadakis, K. Kwok, A. Sotiropoulou</i>	
<b>REMEDIAL ACOUSTICS OF A MONUMENTAL NEOCLASSICAL AUDITORIUM AT TECH. UNIV. ATHENS</b> .....	421
<i>J. Karagiannis, H. Perdikari, G. Poulakos, A. Stamos, A. Sotiropoulou</i>	
<b>LA PHILHARMONIE DE PARIS – ACOUSTIC SCALE MODEL STUDY</b> .....	431
<i>B. Katz, Y. Jurkiewicz, T. Wulfrank, G. Parsehian, T. Scelo, H. Marshall</i>	
<b>ACOUSTICS, PERFORMERS AND AUDIENCES IN MEDIEVAL ENGLISH DRAMA</b> .....	439
<i>M. Lopez</i>	
<b>INVESTIGATION OF THE EFFECTS OF ROOM ACOUSTICS STIMULI ON REWARD REGIONS IN THE BRAIN</b> .....	447
<i>M. Lawless, M. Vigeant</i>	
<b>SUBJECTIVE STUDY ON LISTENER ENVELOPMENT USING HYBRID ROOM ACOUSTICS SIMULATION AND HIGHER ORDER AMBISONICS REPRODUCTION</b> .....	456
<i>M. Neal, M. Vigeant</i>	
<b>DESIGN OF THE SALA MINAS GERAIS CONCERT HALL, BELO HORIZONTE, BRAZIL</b> .....	464
<i>J. Nepomuceno, C. Blair, M. Barron</i>	
<b>AURALIZATION OF VANISHED 19<sup>TH</sup> CENTURY CONCERT HALLS IN HELSINKI</b> .....	470
<i>H. Niemi, M. Kylliainen, J. Jappinen, M. Lindqvist</i>	
<b>THE BERLIN PHILHARMONIC AS A MODEL OF PHILHARMONIC HALLS?</b> .....	478
<i>N. Quienne, C. Semidor</i>	
<b>ACOUSTICS IN THE MULTIPURPOSE HALLS OF THE NEW MAIN LIBRARY AND THE NEW MUNCH MUSEUM IN OSLO</b> .....	486
<i>J. Olshausen, J. Rindel</i>	
<b>SOUND FIELD VISUALIZATION USING THE FINITE-DIFFERENCE TIME-DOMAIN METHOD AND MEASURED SPATIAL ROOM IMPULSE RESPONSES</b> .....	498
<i>J. Saarelma, G. Greco</i>	
<b>QUIET IN AUDITORIA: WHY AND HOW TO STRIVE FOR IT ON BUDGET - AND SITE-CONSTRAINED PROJECTS</b> .....	505
<i>J. Sacks, I. Pieleanu, R. Wolff</i>	
<b>SOUND GOES ROUND: THE QUEST FOR OMNIDIRECTIONAL RADIATION</b> .....	512
<i>N. Shade</i>	
<b>INFLUENCE OF DIFFUSIVE SURFACE POSITION AND EXTENSION ON THE ACOUSTICS OF A SMALL PERFORMANCE SPACE</b> .....	520
<i>L. Shtrepi, F. Cravero, S. Blasio, A. Astolfi, M. Rychtarikova, M. Guski</i>	
<b>SUBJECTIVE ACOUSTIC EVALUATION OF BYZANTINE CHANT IN ORTHODOX CHURCHES OF MODERN GREEK PERIOD</b> .....	528
<i>A. Sotiropoulou, G. Cambourakis, A. Panos, I. Karagiannis, G. Vlachos, T. Servetas</i>	
<b>THE ATHENS ACADEMY OF PERFORMING ARTS; ACOUSTIC DESIGN OF THE 300-SEAT MULTIPURPOSE AUDITORIUM</b> .....	536
<i>A. Sotiropoulou, M. Papaioannou, N. Mougkasi, D. Nikolaou, P. Vasilatos, S. Panagiotou</i>	
<b>BASS IN CONCERT HALLS – RECENT STUDIES ON THE SEAT-DIP EFFECT</b> .....	544
<i>H. Tahvanainen, T. Lokki</i>	
<b>SPATIAL ANALYSIS OF THE ACOUSTICS OF ROCK CLUBS AND NIGHTCLUBS</b> .....	551
<i>S. Tervo, J. Saarelma, J. Patynen, I. Huhtakallio, P. Laukkanen</i>	
<b>INTERNATIONAL CONGRESS CENTRE IN KATOWICE, POLAND: ACOUSTIC DESIGN AND PERFORMANCE</b> .....	559
<i>A. Klosak, A. Gade</i>	
<b>Author Index</b>	